AUSCULTATION OF THE ABDOMEN*

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DISCUSSION *by Frank E. Wiebe, M. D., Salinas; John C. Ruddock, M. D., Los Angeles; H. Brodie Stephens, M. D., San Francisco.*

AUSCULTATION of the abdomen has been practiced too imperfectly and especially too irregularly up to the present, to be esteemed at its just value. It deserves an important place among the methods of examination, and has the advantage of being put into practice immediately at the bed of the patient with the aid only of the stethoscope. It is not intended that auscultation of the abdomen alone will establish the diagnosis, but that, employed in adjunct to our other means of examination, it will give additional pertinent information and at an earlier stage. This method is of especial value in the differential diagnosis of traumatism of the abdominal region, in following the evolution of acute abdominal disease, the evolution of the postoperative course, and formulating their prognosis.

In auscultation of the abdomen there are the variations in the transmission of extrinsic sounds that some, such as Claybrook,[1] Aschner[2] and others, believe are of value; some adventitious sounds, such as peritoneal friction in plastic peritonitis, tinkling of fluids with change of position in ascites, etc., that are rare and of questionable value; and the murmurs from normal peristalsis and modifications of it, chiefly a peristalsis and hyperperistalsis. This paper will deal only with those sounds relating to peristalsis, entering into a discussion of the anatomical background, the phylogenetic cause for the reflexes as they are, the findings as noted in the normal, in the postoperative period, and in the acute abdomen, and the interpretations of these findings.

ANATOMY AND PHYSIOLOGY

The gastro-intestinal tract has been shown by Bayliss and Starling,[3] Cannon,[4,5] Alvarez[6] and others, to be to a large extent autonomous. That is, it has within itself the mechanism essential to peristalsis.

The smooth muscle alone of the gastro-intestinal wall has the power of rhythmic contractions, as witness what happens when a single strip of such muscle, free from all nerve elements, is placed in a proper salt bath. It is necessary, however, to have coördination of these muscle contractions if an orderly sequential progressive action in the gastro-intestinal muscle tube is to be obtained.

The myenteric neuroplexus (Auerbach's), located between the longitudinal and circular intestinal muscle layers, serves for the conduction of the stimuli and the coördination of the peristaltic muscle movements. The myenteric plexus has, in addition, an inhibitive control upon the forceful muscle contractions, preventing thereby local muscle spasms or prolonged regional contractures from occurring. The submucous neuroplexus (Meissner's) located in the submucosa, has to do with reception of stimuli from within the bowel, and the conduction of those impulses to the coördinating myenteric plexus.

To summarize, the smooth muscle has the inherent power of rhythmic contraction; the submucosal plexus receives stimuli from within the bowel, and conducts impulses to the myenteric plexus, and the myenteric plexus conducts stimuli for inhibition of muscle contraction, and coördinates the muscle contractions to give thereby the waves of peristalsis.

The extrinsic nerve associations are through the sympathetic system, arising in the celiac superior plexus and passing to the intestine as the splanchnic nerves, and the parasympathetic arising in the cranial and sacral branches and passing to the intestine as the vagus and sacral nerves. Both sets of nerves pass along the mesenteric vessels, the sympathetic in the subserous coat of the blood vessel and then becoming associated with the muscle directly, while the parasympathetic branches connect directly with the myenteric plexus.

The sympathetic nervous system has an inhibiting effect, slowing the peristalsis and giving relaxation to the intestinal wall. The parasympathetic, on the other hand, has a stimulating effect. The neuro-arcs, through which the stimuli may be carried, giving a reflex action, are not definitely known. Kuntz[7] says "reflexes, mediated through the extrinsic nerves, play only a minor rôle in the control of intestinal activity, yet reflex inhibition of the movements of the small intestine may be brought about by stimulation of any afferent nerve. The reflexes involved are mediated through centers in the medulla and spinal cord, and are carried out through the splanchnic nerves. Inhibition is the only effect on the small intestine which can be brought about by stimulation of afferent nerves." He states further: "Gastro-intestinal motility of certain types probably is myogenic. Whether gastro-intestinal motility of certain other types is initiated in the enteric nervous system or in the enteric musculature must at present be regarded as an open question. Certain reactions, which are commonly recognized as reflexes, are quite certainly initiated in the enteric nervous system and carried out through it."

REFLEXES

On what are our body reflexes based? The theory that the experiences of the human race, from the very origin to the present, has developed certain reflexes of defense for the survival of the race, seems tenable. As Crile[8] has said, every adequate stimulus awakens an ontogenetic (his own personal experience), and phylogenetic (experience of his progenitors) memory or association, and the nerve mechanism evolved makes an appropriate response. Each part of the body has developed specific reactions; for example, burning of the end of the finger stimulates immediate withdrawal; a foreign body in the nostril stimulates a sneeze reflex; a foreign body in the larynx stimulates a cough reflex; and in a like manner the peritoneum, from phylogenetic experiences, has certain inherent reflexes of defense.

* Read before the General Surgery Section of the California Medical Association at the sixty-seventh annual session, Pasadena, May 9–12, 1938.

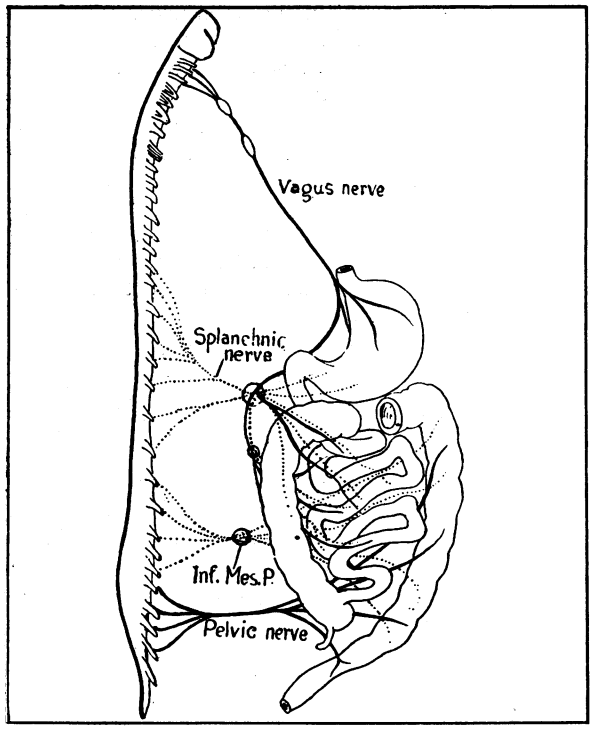

Fig. 1.—Diagram illustrating the distribution of sympathetic and parasympathetic nerves to the stomach and intestine. (Kuntz.)

The reflexes of defense on the part of the abdominal viscera and peritoneum are conditioned, as the others, on adaptation to the past environmental experience, when "man had to fight or flee." Therefore, we see these reflexes conditioned as to response, but not as to cause. The peritoneum has been endowed with powers to resist and overcome any harmful interference, such as trauma or infection, by localization. This is accomplished by reflex action where the abdominal wall is held still and rigid, the diaphragm held immobile, and the intestinal wall held still and rigid by a local inhibition of muscle contractions and intestinal distention. Now, whereas the invasion by infection or the incident of an open traumatic wound of the peritoneal cavity, or a perforation of an intra-abdominal viscus, originally was the stimulus to reaction, today modern aseptic surgery with the handling, the more or less chilling, or the use of chemicals of and upon the abdominal viscera and peritoneum, obtains the same response.

To recapitulate, there are definite defense reflexes of the peritoneum and abdominal viscera developed from phylogeny, not conditioned as to cause, but definite in response and characterized by immobilization in order to obtain localization.

One may go further and observe that, from stimuli within the gastro-intestinal tract, certain reflexes of defense for the same phylogenetic reason apparently occur, namely, any gastro-intestinal irritant, as a purge or poison, will stimulate more or less violent peristalsis in order to eliminate it. If an obstruction of the gastro-intestinal tract occurs, then a violent peristaltic action is set up. On the other hand, a foreign body in the gastro-intestinal tract will, if it tends to penetrate into the peritoneal cavity, be followed by a local quietude of that portion of bowel.

Therefore, the presence of a normal peristalsis or variation from it has a definite significance, and if by some study, such as auscultation of the abdomen, one can say as to the state of peristalsis, then more definite conclusions as to diagnosis and prognosis should follow.

PERISTALTIC SOUNDS

The peristaltic sounds as heard by the stethoscope are divided into three states:[9] (1) the state of normal peristalsis; (2) the state of aperistalsis, quietude, or absence of peristalsis; and (3) the state of abnormal or hyperperistalsis, or "rush peristalsis."

The state of normal peristalsis is recognized by the presence of normal intestinal segmental or mixing movements, myogenic in origin, characterized by soft purring, low-pitched gentle sounds, quite generally distributed over the entire abdomen, but best heard in the right lower quadrant, and more or less constant in action, dependent upon the degree of stimulation from the gastro-intestinal content. For example, after the taking of food, very active segmental motions are present for one to two hours; while, on the other hand, during the period of sleep some six hours posteating, only an occasional sound significant of motion is heard. There is also in this stage the normal peristaltic progressive movement characterized by a medium long higher-pitched gurgle, to a rumble, with occasional tinkles and gentle, squirting noises occurring at quite regular rate, and as frequently as once at least every three minutes.

The state of aperistalsis, quietude or absence of peristalsis, is as the terms denote. It is usually not complete, but may be so for brief periods dependent upon the exciting cause and its extent. One should always listen, however, for three minutes before concluding that there is a silent abdomen. It occurs definitely by an intrinsic reflex involving the peritoneum and the smooth muscle of the gastro-intestinal tract through the myenteric plexus, but may also occur through the extrinsic reflex arc. Aperistalsis is seen after abdominal surgery ordinarily up to twenty-four hours, dependent upon the degree of trauma, rough handling, chilling of tissue abnormally, injury from irritating solutions, etc., that may occur; in any instance, accompanied by irritation of the peritoneum, as peritonitis, intraperitoneal hemorrhage, intraperitoneal leakage from the gastro-intestinal tract, urinary tract or biliary tract; pancreatitis with intraperitoneal involvement and traumatic wounds rupturing into the peritoneal cavity.

Aperistalsis, on the basis of extrinsic causes, is thought to occur through a reflex that passes afferently via the splanchnics. Such extrinsic causes are postperitoneal hemorrhage; trauma, as traction or blows in the region of the solar plexus; sudden and permanent hyperextension of the spine in a body cast; sudden release of an accustomed, intra-abdominal pressure, as post-cesarean section or removal of a large intra-abdominal tumor; a crushing injury of the testis or a strangulation of the sper-

matic cord; torsion of an ovarian pedicle; injuries of the spine; and occasionally with ureteral calculus or subsequent to ureteral and kidney studies by cystoscopic examination.

A word should be said here as to the term "paralytic ileus." It is a term "ill chosen," [10] probably never occurs, and is a relic term of the time when auscultation of the gastro-intestinal tract was not made. Inhibition of peristalsis or "splinting" of the bowels is the proper term, and is what actually occurs.

Abnormal peristalsis occurs in such conditions where intra-intestinal irritation is present, as from purges, ingested irritable material, poisons or foreign bodies; an intestinal obstruction from any cause; in intragastro-intestinal hemorrhage; occasionally in instances of achylia gastrica; normally in individuals of the hypertonic or vagotonic type; often accompanying the bite of the black spider; following the intravenous administration of hypertonic sodium chlorid solution; following the use of smooth muscle stimuli, as pitressin; and in instances of spinal anesthesia, where paralysis of the splanchnic nerves (sympathetic system) is obtained.

The sounds of hyperperistalsis are characterized by loud gutteral to high-pitched tones, squeaks, booms and hissing, musical sounds varying in degree, intensity and frequency, dependent upon the intestinal content of fluid and air and the cause of the irritation. For example, an acute intestinal obstruction gives at first a very vigorous hyperactive rapid peristalsis, and later, as the bowel becomes distended and fatigued, an infrequent sluggish peristalsis.

INTERPRETATION

Auscultation of the abdomen is of special value in peritonitis, acute abdominal conditions such as appendicitis, perforations of visci, intraperitoneal hemorrhage, intestinal obstruction, in differentiation in cases of traumatism about the abdomen, flanks, lumbar, and pelvic regions as to the presence or not of intraperitoneal injury, and of inestimable value in observation of the progress of the postoperative period.

In instances of irritation of the peritoneum, according to the reflexes of defense, one finds by auscultation a decrease to cessation of peristalsis. In peritonitis; appendicitis when there is neighborhood peritoneal involvement; in leakage from any viscus; from intraperitoneal hemorrhage or from external injury as an open wound, then immobilization of the intestine to protect occurs, and aperistalsis ensues. If there has been trauma in the vicinity of the abdomen, but no intraperitoneal injury, then peristalsis will be present. Active peristalsis under these circumstances would then be significant of no intraperitoneal injury and an exploratory celiotomy is avoided.

If, on the other hand, there is some intraintestinal irritant or an intestinal obstruction, then hyperperistalsis will be present. In intestinal obstruction, hyperperistalsis is at the start frequent, vigorous and loud, but at a later stage occurs at infrequent intervals, and is then of a lazy, slow, but loud type. Progressive movements are the type present, while segmental motions are usually absent.

Auscultation, in the postoperative course of an uncomplicated celiotomy, reveals most often only occasional peristaltic sounds up to twenty-four hours, and not infrequently no cessation of peristaltic sounds whatsoever. During this initial period of aperistalsis, fluids taken will remain in the upper gastro-intestinal tract and lead to gastric distention and regurgitation, and possibly vomiting. If, therefore, one listens and only when peristalsis has become relatively active, starts fluids by mouth, he will not have the frequent upper gastro-intestinal distress. Frequently enemata are given to relieve gas, believing there is some "paralytic ileus," whereas auscultation of the abdomen will usually reveal an active peristalsis and the enema as unnecessary. In addition, the enema frequently but temporarily upsets the returning smooth muscle coördination as well as the patient's morale, and besides creates unnecessary work for the nursing staff. Pitressin or other smooth muscle stimulants are given to provoke peristalsis when, if auscultation were employed, there would be revealed peristalsis already progressing satisfactorily and, therefore, no need for this whipping up of smooth muscle action guided by reflexes of phylogenetic development.

Auscultation of the abdomen gives us definite and earlier knowledge of the return of gastro-intestinal function, when fluids and food by mouth may be started, and when the rectal tube to overcome anal sphincter tonicity is indicated. If there are complications occurring, as a local peritonitis or an unsuspected intestinal obstruction, then an inhibition of peristalsis or hyperperistalsis (as the case may be), will be present, the condition more promptly recognized, and the proper postoperative care adjusted.

REPORT OF CASES*

CASE 1.—W. C. H., No. 30781. This case is presented for the observance of a normal postoperative course. A female, age twenty-nine, with an apparent pregnancy of three months, accompanied by irregular cervical bleeding, "spotting," experienced, at two months, severe lower abdominal pain and an acute pelvic tenderness which persisted, although at a milder degree. Physical examination revealed a uterus of apparently two months' pregnancy, no uterine bleeding, and a retro-uterine firm, slightly tender, nonmobile mass filling the Douglas pouch. The Aschheim-Zondek test was positive at one and a half months of the pregnancy, and questionable at three months' period. The diagnosis was a tubal pregnancy complicated by probably nonviable fetus, and was so proved. Treatment consisted of celiotomy, left salpingectomy for an intratubal pregnancy, and appendectomy. There was no undue exposure of viscera. Recovery.

Comment.—This case record is illustrative of a celiotomy with considerable surgery and a smooth postoperative course. Twenty-four hours postoperatively there was beginning peristalsis, but not as frequent or sustained as normal, generally distributed, and unaccompanied by any nausea or vomiting. This signified that gastro-intestinal movements were present, and could carry gastro-intestinal content on to a partial degree only. Limited fluids were allowed, and during the next twelve hours the patient took by mouth 970 cubic centimeters. The second twenty-four hours was charac-

* Only two of twelve case reports submitted with the author's paper are here given. Others will appear in the reprints.

terized by a decrease in peristaltic activity, and a coincidental occurrence of some nausea and slight distention. Fluids by mouth were, therefore, stopped and supplemented by intravenous glucose. The third twenty-four-hour period was characterized by a return to an active and normal peristalsis, no further nausea, and passage of flatus freely. This active peristalsis suggested that the "reflexes of defense" from whatever cause, presumably the trauma of surgery, were past. From then on the patient's convalescence was uneventful, peristalsis normal, and all fluids after the second day were taken entirely by mouth without distress.

Thus the observation of the presence and the type of peristalsis indicated when fluids could be taken by mouth, when they should be limited, and when they could again be started and continued.

CASE 2.—W. C. H., No. 30780. This case is illustrative of an instance of peritonitis and the relation of peristalsis to this. A female, age twenty-two, experienced a gradual onset of a persistent, steady, nonradiating lower abdominal pain, worse with movement, accompanied by diarrhea at the start, vaginal discharge, marked general malaise, and nausea and vomiting. Physical examination revealed, at the start, lower abdominal general tenderness without any muscle guarding; bilateral pelvic masses with marked tenderness; and a temperature of 103 and pulse of 120. From the sixth to the tenth day there occurred some distention with lower abdominal muscle guarding. The final diagnosis, and so proved, was acute pelvic inflammatory disease with pelvic peritonitis. Treatment consisted of rest, Fowler position, ice bags to abdomen, long, hot vaginal douches, fluids intravenously and subcutaneously, especially during the sixth to tenth days of illness, celiotomy on the twenty-first day with bilateral salpingostomy and appendectomy. Recovery.

Comment.—Case 2 is illustrative of an occurrence of peritonitis and the corresponding defense reflexes. This patient's condition was considered to be an acute pelvic inflammatory disease and later, before surgery, as a probable pelvic appendicitis with abscess formation. At the start, for six days, there was active peristalsis, accompanied by no abdominal spasticity and only a low abdominal tenderness. Then the patient became more ill, had aperistalsis with accompanying moderate distention and tenderness of the lower abdomen. This condition continued for four days when, coincident with a return of peristalsis, to just over the pelvis, she showed general improvement and recession of the tenderness. By the twentieth day, postonset, normal peristalsis was well established and there was no further abdominal tenderness or spasticity, and only a remaining tender mass in the right pelvic adnexal region. Her temperature returned, likewise, to normal.

The peristalsis present and active during the first six days occurred while the findings were of an acute inflammatory process entirely limited to the pelvic cavity. On the sixth day, however, peristalsis suddenly ceased, and coincidentally there occurred abdominal distention, slight abdominal muscle guarding, and a general toxic state. This represents the occurrence of a spreading lower abdominal peritonitis, with demonstration of the defense reflex to wall off the spreading infection, namely, aperistalsis, distention and abdominal wall muscle rigidity. On the tenth day peristalsis began and, coincidentally, the abdominal distention decreased, the temperature lowered and the patient's general condition improved. This represents a conquering of the peritoneal invasion, no further stimulation of the defense reflexes, and a return to normal smooth muscle function.

The entire clinical course was followed by auscultation of the abdomen and treatment employed as indicated; that is, during the aperistaltic period fluids were withheld by mouth and given by the intravenous and subcutaneous methods, and a Levine gastric tube for gastric drainage employed for a brief period. When normal peristalsis returned, fluids, and later food, by mouth were gradually allowed.

Afterward the patient was operated upon, and the evidence found revealed the occurrence of a pelvic inflammatory disease with definite "walling off" by recent interintestinal and omental adhesions of the process to the pelvic cavity.

CONCLUSIONS

1. Auscultation of the abdomen is a method of examination of definite value and should be employed in adjunct to the other means of examination.
2. The presence and type of peristalsis, or the absence of peristalsis, is of significance in interpretation of any intraperitoneal irritation.
3. The inhibition of peristalsis is a reflex of defense on the part of the body to a peritoneal insult.
4. The application of the value of auscultation of the abdomen, as regards typical conditions directly or indirectly related to peritoneal injury, are given and discussed.

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DISCUSSION

FRANK E. WIEBE, M. D. (610 Salinas National Bank Building, Salinas).—Doctor Woolsey has, in his usual clear and direct way, presented to us the little-used method of abdominal examination. He has discussed the anatomy and physiology involved, and has pointed out the peritoneal reflex producing inhibition of peristalsis, this reflex being initiated by any irritation, which may be chemical, mechanical, or inflammatory.

Since it has been my privilege to review this paper previously, we have taken advantage of abdominal auscultation, both for diagnosis and for following our patients postoperatively. Our most unusual impressions have been in cases of acute appendicitis in which, as the author has stated, peristalsis is inhibited in the right lower quadrant, due to an inflammatory peritoneal reflex.

A case in which we felt the clinical and laboratory findings outweighed the findings of abdominal auscultation, and which was diagnosed as acute appendicitis, proved the value of this sign. A five-year-old child, ill about ten hours with abdominal pain localizing in the right lower quadrant with definite right lower quadrant tenderness and muscle protection and rebound tenderness. The white blood count of 20,000 with 82 per cent polymorphonuclears, but with peristalsis active over the entire abdomen including the right lower quadrant, was diagnosed as acute appendicitis. On operation, we found an appendix only slightly inflamed, but in the region of the terminal ileum were a number of large red glands.

Postoperatively, we have been impressed with the absence of distress in our patients since we have been permitting only minimal amounts of fluid by mouth until peristalsis had begun, food being withheld until peristalsis has become active.

I want to thank Doctor Woolsey for presenting this method, and feel that anyone who has not utilized it will find it a valuable addition to his method of examination.

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JOHN C. RUDDOCK, M. D. (1930 Wilshire Boulevard, Los Angeles).—The art of the practice of medicine which, in the absence of mechanical aids, was highly developed in our forebears, has been sadly neglected. Much dependence and finality is placed upon the findings of the roentgenologist, the hematologist, the chemist, and the bacteriologist to make the diagnosis. The five senses of man have been relegated to a minor position. Doctor Woolsey has called our attention again, and pointed out the value in diagnosis and the determination of course of treatment on the simple procedure of auscultation of the abdomen. No expensive equipment is necessary. No time is involved in the interpretation or decision. Every doctor has a stethoscope and is trained in its use. Interpretation of the intra-abdominal pathology is dependent on the physiological response to the reflex stimulated by the lesion, *i. e.*, peristalsis of the intestine. The art of the practice of medicine by applying one special sense—hearing.

Auscultation of the abdomen becomes of value in differential diagnosis in acute coronary thrombosis with abdominal splinting, or early lobar pneumonia and diaphragmatic pleurisy with reflex aperistalsis. Mesenteric thrombosis usually presents problems calling for all the skill and ancillary methods at the disposal of the clinician. Small amounts of ascites often give the patient a feeling of distention, but auscultation will reveal normal peristaltic sounds.

Many abdominal conditions when suspected are more clearly defined and localized if the simple procedure of auscultation is done. No abdominal examination is complete unless the stethoscope is used as a part of such examination.

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H. BRODIE STEPHENS, M. D. (384 Post Street, San Francisco).—Doctor Woolsey, in his customary manner, has presented to us a valuable contribution. He has called to our attention the many aids provided by the intelligent use of the stethoscope; he has particularly stressed the use of this instrument in helping the surgeon arrive at a correct diagnosis of various intra-abdominal diseases, as well as the successful management of the patient following operation.

While hearing Doctor Woolsey's presentation, the oft-time repeated words of the late John B. Deaver came back to me. When speaking of the silent abdomen, which follows the intraperitoneal rupture of an acute suppurative process within the appendix, Doctor Deaver would relate how the surgeon should frequently listen to the abdomen through the stethoscope. In his masterful and dramatic manner he would exclaim, "And now the tinkle of peristaltic waves becomes audible, which means the peritonitis is subsiding, and this indeed is music to the surgeon's ears!"

Doctor Woolsey has justly stressed the great value which lies in this simple method of physical examination. All of us, no doubt, tend to neglect the use of our eyes and ears when we have so many modern laboratory aids at hand. This neglect will certainly do the patient no good and may do him much harm.

It had not occurred to me before hearing Doctor Woolsey's paper how accurately one actually is able to follow his patient's postoperative course by the daily use of the stethoscope. Certainly, we have here an honest indication of what the gut is really doing. Doctor Woolsey is probably very correct in telling us we could dispense with much of our postoperative treatment if we would only use the stethoscope more frequently and intelligently.

A paper such as we have just heard seems to me to be a good one to keep close at hand, one to be read every six months or so. I feel certain that after each reading we shall be better doctors and less dependent on the laboratory.

In closing, I should like to congratulate the author for his excellent paper and to congratulate his patients, too. I believe them to be lucky people!

CALIFORNIA STATE HOSPITALS*

THE PROBLEM OF OVERCROWDING

By AARON J. ROSANOFF, M.D.
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THIS meeting has been called mainly for the purpose of laying before you a plan of attack on the problem of overcrowding in State hospitals; for even a partial and hasty survey of the institutions in our Department has revealed this problem as the largest and most urgent one among those that present themselves at the present time. I need not cite the statistics, which are but too well known to you all. The great fact is that our overcrowding is so great as to be physically and mentally unhygienic, esthetically revolting, and altogether intolerable.

PROBLEM OF OVERCROWDING

This problem is neither new nor peculiar to the State of California. On the contrary, it has existed now for fully a century, in more or less marked degree, in practically every state in the Union. The obvious lesson to be learned, not only from our own experience, but also, and even more impressively, from that of older and more populous states, is that the building of new hospitals, or the enlargement of existing ones, or both, no matter on how large a scale, seems to afford but partial and temporary relief at best. Every state in the Union has had under way for many years an

* From the office of the Director of Institutions, State of California.
Read at a special meeting of medical superintendents and social workers, held at the Stockton State Hospital on January 10, 1939.